

Serial No.: 09/998,080

B1
concl'd

reactant vapor species comprising the Group III metal and nitrogen. The reactant vapor species is deposited on the growth surface to produce a single-crystal M^{III}N layer thereon. In one aspect, the single-crystal M^{III}N layer is grown as a thin film, i.e., with a thickness of approximately 10 to 10,000 mn (.01 to 10 microns), for use as a seed crystal upon which a bulk, second M^{III}N layer can be grown. In another aspect, growth of the M^{III}N layer is permitted to continue beyond the thin film range until its thickness is sufficient to ensure that the resulting bulk crystal has a low enough defect density to be considered as device-quality. In a further aspect, the M^{III}N layer is grown to a bulk thickness and the template material is removed, thereby providing a free-standing, single-crystal M^{III}N article having a diameter of approximately 0.5 inch or greater and a thickness of approximately 50 microns or greater. — —

IN THE CLAIMS:

Please cancel claims 15 and 25 ~~31~~.

Please amend claims 1, 18 – 24, 32, 33, 37 – 40 and 44 as follows:

- B2
1. (Amended) A method for producing a single-crystal M^{III}N article comprising the steps of:
 - (a) providing a template material having an epitaxial-initiating growth surface;
 - (b) sputtering a Group III metal target in a plasma-enhanced environment to produce a Group III metal source vapor;
 - (c) combining the Group III metal source vapor with a nitrogen-containing gas to produce a reactant vapor species comprising Group III metal and nitrogen; and
 - (d) depositing the reactant vapor species on the growth surface to produce a single-crystal M^{III}N layer thereon having a thickness of greater than approximately 10 microns.
- B3
18. (Amended) The method according to claim 59 wherein the M^{III}N article is provided in a form selected from the group consisting of intrinsic M^{III}N,

Serial No.: 09/998,080

doped $M^{III}N$, and $M^{III}N$ alloys and compounds containing greater than 50% M^{III} and N.

- B2
concl'd
19. (Amended) The method according to claim 59 wherein the $M^{III}N$ article has a diameter of approximately 2 inches or greater and a thickness of approximately 1 mm or greater.
 20. (Amended) The method according to claim 59 wherein the template material is removed by a removal technique selected from the group consisting of polishing, chemomechanical polishing, laser-induced liftoff, cleaving, wet etching, and dry etching.
 21. (Amended) The method according to claim 59 comprising the step of cutting a wafer from the $M^{III}N$ article.
 22. (Amended) The method according to claim 59 comprising the step of preparing a surface of the $M^{III}N$ article for epitaxial growth thereon.
 23. (Amended) The method according to claim 59 comprising the step of depositing an epitaxial layer on the $M^{III}N$ article.
 24. (Amended) The method according to claim 59 comprising the step of forming a device on the $M^{III}N$ article.

- B3
32. (Amended) The method according to claim 62 wherein the additional reactant species are deposited by a technique selected from the group consisting of physical vapor deposition, sputtering, molecular beam epitaxy, atmospheric chemical vapor deposition, low pressure chemical vapor deposition, plasma-enhanced chemical vapor deposition,

Serial No.: 09/998,080

metallorganic chemical vapor deposition, evaporation, sublimation, and hydride vapor phase epitaxy.

33. (Amended) The method according to claim 62 comprising the step of cutting a wafer from the bulk $M^{III}N$ article.

37. (Amended) A bulk single-crystal $M^{III}N$ article produced according to the method of claim 59 wherein the article has a thickness of approximately 50 microns or greater.

38. (Amended) A single-crystal $M^{III}N$ article produced according to the method of claim 59, wherein the article is in wafer form having a thickness ranging from approximately 50 microns to approximately 1 mm.

39. (Amended) A single-crystal $M^{III}N$ article produced according to the method of claim 59, wherein the article is in boule form having a diameter of approximately 2 inches or greater and a thickness ranging from approximately 1 mm to greater than approximately 100 mm.

40. (Amended) A method for producing a single-crystal $M^{III}N$ article comprising the steps of:

- (a) providing a template material having an epitaxial-initiating growth surface;
- (b) using a sputtering apparatus comprising a non-thermionic electron/plasma injector assembly to produce a Group III metal source vapor from a Group III metal target;
- (c) combining the Group III metal source vapor with a nitrogen-containing gas to produce a reactant vapor species comprising Group III metal and nitrogen; and

Serial No.: 09/998,080

- B4
Conced
- (d) depositing the reactant vapor species on the growth surface to produce a single-crystal $M^{III}N$ layer thereon.

- B5
44. (Amended) A bulk single-crystal $M^{III}N$ article produced according to the method of claim 40 wherein the article has a thickness of approximately 50 microns or greater.

B6

[Please add the following new claims 57- 67:]

57. (New) The method according to claim 1 wherein the $M^{III}N$ layer has a diameter of approximately 0.5 inch or greater.
58. (New) The method according to claim 1 wherein the $M^{III}N$ layer is provided in a form selected from the group consisting of intrinsic $M^{III}N$, doped $M^{III}N$, and $M^{III}N$ alloys and compounds containing greater than 50% M^{III} and N.
59. (New) The method according to claim 1 comprising the steps of continuing to deposit the reactant vapor species on the growth surface whereby the $M^{III}N$ layer attains a thickness sufficient to enable removal of the template material, and removing the template material to provide a free-standing, single-crystal $M^{III}N$ article.
60. (New) The method according to claim 59 wherein the $M^{III}N$ article has a thickness of approximately 50 microns or greater.
61. (New) The method according to claim 60 wherein the $M^{III}N$ article has a diameter of approximately 0.5 inch or greater.
62. (New) A method for producing a bulk single-crystal $M^{III}N$ article comprising the steps of:

B6
cont.

- (a) providing a template material having an epitaxial-initiating growth surface;
 - (b) sputtering a Group III metal target in a plasma-enhanced environment to produce a Group III metal source vapor;
 - (c) combining the Group III metal source vapor with a nitrogen-containing gas to produce a reactant vapor species comprising Group III metal and nitrogen;
 - (d) depositing the reactant vapor species on the growth surface to produce a single-crystal $M^{III}N$ layer thereon; and
 - (e) using the single-crystal $M^{III}N$ layer as a seed crystal to grow a bulk $M^{III}N$ layer by depositing additional reactant vapor species comprising a Group III metal and nitrogen on the seed crystal.
63. (New) A bulk single-crystal $M^{III}N$ article produced according to the method of claim 62 wherein the article has a thickness of approximately 50 microns or greater.
64. (New) A single-crystal $M^{III}N$ article produced according to the method of claim 62, wherein the article is in wafer form having a thickness ranging from approximately 50 microns to approximately 1 mm.
65. (New) A single-crystal $M^{III}N$ article produced according to the method of claim 62, wherein the article is in boule form having a diameter of approximately 2 inches or greater and a thickness ranging from approximately 1mm to greater than approximately 100 mm.
66. (New) The method according to claim 40 comprising the step of using the single-crystal $M^{III}N$ layer as a seed crystal and depositing additional reactant vapor species comprising the Group III metal and nitrogen on the $M^{III}N$ layer to produce a bulk, homoepitaxially grown $M^{III}N$ article.